

## REGIONAL COMPETITION - ROUND 2

### TOSS-UP

1. ERSC; Multiple Choice: The location of subterranean caves and passages can sometimes be determined by mapping small variations in the earth's gravity. Would a cave be easier to detect if it were:
  - a) Water-filled
  - b) Mud-filled
  - c) Air-filled
  - d) Rock-filled

ANSWER: C--AIR-FILLED

### BONUS

1. ERSC; Multiple Choice: Which of the following would NOT affect local gravity values and could be ignored when analyzing the gravity data.
  - a) Elevation of measurement point
  - b) Longitude of measurement point,
  - c) Position of the moon at the time of the measurement,
  - d) Solar flare activity levels at the time of the measurement,

ANSWER: D--SOLAR FLARE ACTIVITY

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### TOSS-UP

2. CHEM; Short Answer: What is a substance called which can increase the rate of a chemical reaction without being consumed by it?

ANSWER: CATALYST

### BONUS

2. CHEM; Multiple Choice: Utilizing the Gibbs-Helmholtz equation, what can be said of a reaction where the change in enthalpy is always positive and the change in entropy always negative?
  - a) Spontaneous at all temperatures
  - b) Reverse reaction is spontaneous
  - c) Spontaneous only at high temperatures
  - d) Spontaneous only at low temperatures

ANSWER: B--REVERSE REACTION IS SPONTANEOUS

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**TOSS-UP**

3. COMP; Multiple Choice: How many types of file organizations does BASIC allow?
- a) 1
  - b) 3
  - c) 5
  - d) None of the Above

ANSWER: B--3

**BONUS**

3. COMP; Short Answer: What are the two types of constants in BASIC?

ANSWER: NUMERIC AND STRING

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**TOSS-UP**

4. BIOL; Multiple Choice: The lipoprotein which transports triglycerides to the muscle and fat cells to be used for energy or to be stored for later use is called:
- a) High density lipoprotein
  - b) Low density lipoprotein
  - c) Very low density lipoprotein
  - d) Apolipoprotein B (pron: ap-o-lip-o-pro'-teen)

ANSWER: C--VERY LOW DENSITY LIPOPROTEIN

**BONUS**

4. BIOL; Short Answer: To which vitamin does the body convert beta carotene?

ANSWER: VITAMIN A

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### TOSS-UP

5. PHYS; Multiple Choice: A resistor R and inductor L are connected in series with a battery and the circuit current is 10 amperes. The battery is shorted out of the circuit at time  $t = 0$ . What is the current at time  $t = L/R$ ?
- a) zero
  - b) 5 amperes
  - c) 3.7 amperes
  - d) 0.37 amperes

ANSWER: C--3.7 AMPERES (the current has decreased to  $1/e$  of its original value)

### BONUS

5. PHYS; Multiple Choice: The term "flammable liquid" is defined as:
- a) A liquid having a flash point at or above 100 degrees F (37.8 degrees C).
  - b) A liquid having a flash point at or below 100 degrees F (37.8 degrees C).
  - c) A liquid having a flash point at or above 32 degrees F (0 degrees C).
  - d) A liquid having a flash point at or below 212 degrees F (100 degrees C).

ANSWER: B--A LIQUID HAVING A FLASH POINT AT OR BELOW 100 DEGREES F (37.8 DEGREES C).

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### TOSS-UP

6. GENR; Short Answer: Amateur short wave radio often employs which type of AM transmission?

ANSWER: SINGLE SIDEBAND OF DOUBLE SIDEBAND

### BONUS

6. GENR; Multiple Choice: A signal which has been increased 3 decibels has increased in power by approximately how much?
- a) 3 times
  - b) 1.5 times
  - c) 2 times
  - d) 10 times

ANSWER: C -- 2 TIMES

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### TOSS-UP

7. CHEM; Short Answer: Chlorophyll, vitamin B12, and heme (pron: heem) are examples of complexes consisting of metal ions bonded to organic compounds in ring structures. What are these complex compounds known as?

ANSWER: CHELATES (ACCEPT METAL CHELATES)

### BONUS

7. CHEM; Multiple Choice: Colloids are very fine particles which exist in size somewhere between the dissolved state and about 1 micron in diameter. One of the outstanding properties of colloids is the adsorption of cations from the bulk solution. What characteristic of colloids is primarily responsible for this property?
- a) large surface area
  - b) double layer thickness
  - c) zeta potential
  - d) pH of the bulk solution

ANSWER: A-- LARGE SURFACE AREA

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### TOSS-UP

8. ASTR; Short Answer: What is the change of direction of the earth's polar axis is known as?

ANSWER: PRECESSION (ACCEPT CHANDLER WOBBLE)

### BONUS

8. ASTR; Multiple Choice: Approximately how long does it take the earth's polar axis to make one revolution?
- a) 200 years
  - b) 2,000 years
  - c) 20,000 years
  - d) 200,000 years

ANSWER: C--20,000 YEARS

**TOSS-UP**

9. BIOL; Multiple Choice: A red eft is:
- a) the dark phase of a newborn deer
  - b) a desert dwelling owl
  - c) a common moth
  - d) a salamander

ANSWER: D--A SALAMANDER

**BONUS**

9. BIOL; Multiple Choice: The organism associated with acid mine drainage is
- a) *Chlorella vulgaris* (pron: clo-rel'-la vul-gar'-is)
  - b) *Tetraselmis suecica* (pron: te'-tra-sel'-mus soo-eh-sea'-ka)
  - c) *Cyanidium caldarium* (pron: si-uh-nid'-e-um cal-dare'-e-um)
  - d) *Thiobacillus feroxidans* (pron: the'-o-ba-sil'-us fair-ox'-uh-dans)

ANSWER: D--THIOBACILLUS FEROXIDANS

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**TOSS-UP**

10. MATH; Short Answer: A plane curve generated by a point moving so that its distance from a fixed point is equal to its distance from a fixed line is a:

ANSWER: PARABOLA

**BONUS**

10. MATH: Multiple Choice; Of three prisoners, X, Y, and Z, on death row, one has been chosen by lot to be pardoned. Prisoner X learns that of prisoners Y and Z, prisoner Z will be executed. What is the probability that prisoner X will be pardoned?
- a) 0
  - b)  $1/3$
  - c)  $1/2$
  - d)  $2/3$

ANSWER: B-- $1/3$

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### TOSS-UP

11. PHYS; Multiple Choice: Flash point is defined as:
- a) The minimum temperature at which sufficient vapor is released by a liquid or solid to form an ignitable vapor-air mixture at atmospheric pressure.
  - b) The minimum temperature at which a liquid or solid will self-ignite at atmospheric pressure.
  - c) The maximum temperature at which a liquid or solid can sustain without self-ignition.
  - d) The minimum temperature at which all of a liquid will eventually "flash" into a vapor without reaching the lower explosive limit.

ANSWER: A--THE MINIMUM TEMPERATURE AT WHICH SUFFICIENT VAPOR IS RELEASED BY A LIQUID OR SOLID TO FORM AN IGNITABLE VAPOR-AIR MIXTURE AT ATMOSPHERIC PRESSURE.

### BONUS

11. PHYS; Multiple Choice: The speed of sound in air is approximately .333 kilometers per second. Sound travels faster in water than in air. What is the approximate speed of sound in water?
- a) .48 kilometer per second
  - b) 1.48 kilometers per second
  - c) 2.48 kilometers per second
  - d) 3.48 kilometers per second

ANSWER: B--1.48 KILOMETERS PER SECOND

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### TOSS-UP

12. CHEM; Short Answer: What is light reflected off of colloids, at right angles to an incident beam, known as?

ANSWER: THE TYNDALL EFFECT

### BONUS

12. CHEM; Short Answer: What is the chemical in onions that causes tears to form in your eyes?

ANSWER: METHYL SULFOXIDE

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**TOSS-UP**

13. COMP; Short Answer: Using odd-parity, the parity bit for the number 10111 would be:

ANSWER: ONE (1)

**BONUS**

13. COMP; Short Answer: A new logic circuit for determining the potential of superconducting technology for high-speed digital computation is called RSFQ. What does this stand for?

ANSWER: RAPID SINGLE FLUX QUANTUM (LOGIC)

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**TOSS-UP**

14. BIOL; Multiple Choice: Evolution is likely to occur when:

- a) reproduction is random
- b) selection pressures affect gene frequency
- c) no mutations
- d) there is no immigration or emigration

ANSWER: B--SELECTION PRESSURES AFFECT GENE FREQUENCY

**BONUS**

14. BIOL; Multiple Choice: Some bats in the northern hemisphere migrate before they enter hibernation for the winter. Do they:

- a) fly north
- b) fly south
- c) move into a deeper part of the cave
- d) fly to the southern hemisphere

ANSWER: A--FLY NORTH

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**TOSS-UP**

15. ASTR; Multiple Choice: What are the two common types of meteorites?
- a) Stones and irons
  - b) Ices and rocks
  - c) Silicates and rocks
  - d) Ices and metals

ANSWER: A--STONES AND IRONS

**BONUS**

15. ASTR; Multiple Choice: The term "Hubble's constant" is most closely related to:
- a) The masses of stars
  - b) The expansion of the universe
  - c) Quasar formation
  - d) The Milky Way

ANSWER: B--THE EXPANSION OF THE UNIVERSE

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**TOSS-UP**

16. PHYS; Short Answer: If a scuba diver is breathing compressed air and descends to a depth of 99 feet, what percentage of oxygen is he breathing at this depth?

ANSWER: 20 PERCENT. (ACCEPT 19-21) THE EFFECTS OF THE PRESSURIZED GAS ARE DIFFERENT, BUT THE PERCENTAGES OF THE GASES IN THE SCUBA CYLINDER DO NOT CHANGE

**BONUS**

16. PHYS; Short Answer: A scuba diver is at a depth of 33 feet. What is the TOTAL number of atmospheres he is exposed to?

ANSWER: 2 (1 FROM THE 33-FOOT COLUMN OF WATER ABOVE HIM AND 1 FROM THE ATMOSPHERE ITSELF)

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**TOSS-UP**

17. CHEM; Multiple Choice: What is the most dense naturally occurring element?
- a) lead
  - b) gold
  - c) osmium
  - d) platinum

ANSWER: C--OSMIUM

**BONUS**

17. CHEM; Short Answer: Name five of the seven elements present in ordinary window glass.

ANSWER: OXYGEN, SILICON, SODIUM, MAGNESIUM, CALCIUM, ALUMINUM, AND IRON

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**TOSS-UP**

18. ERSC; Multiple Choice: In collection of a groundwater sample, the pH of the sample may change because of:
- a) changes in CO<sub>2</sub> concentration
  - b) exposure to light
  - c) contact with O<sub>2</sub> in the air
  - d) nitrogen fixation

ANSWER: A--CHANGES IN CO<sub>2</sub> CONCENTRATION

**BONUS**

18. ERSC; Multiple Choice: Why should groundwater samples collected for trace metal analysis be acid-preserved?
- a) to maintain a specific pH
  - b) to maintain chemical equilibria
  - c) to prevent adsorption onto container walls
  - d) to cause precipitation of trace metals

ANSWER: C--TO PREVENT ADSORPTION ONTO CONTAINER WALLS

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### TOSS-UP

19. GENR; Multiple Choice: What kind of filter is made from a series capacitor with an inductor shunted across a resistive load?
- a) Low pass
  - b) High pass
  - c) Bandpass
  - d) Complex

ANSWER: B--HIGH PASS

### BONUS

19. GENR; Multiple Choice: Which of the following are true concerning capacitance and inductance under steady state conditions?
- a) Inductor behaves like short circuit at DC
  - b) Capacitor behaves like open circuit at DC
  - c) Inductive reactance increases with frequency
  - d) All of the above

ANSWER: D--ALL OF THE ABOVE

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### TOSS-UP

20. PHYS; Multiple Choice: A balloon is inflated under water sufficiently to provide two pounds of buoyancy at the ocean's surface. If a one-pound weight is attached to the balloon and carried down to a depth of 100 feet, what will happen if the balloon and weight are released?
- a) They will sink.
  - b) They float to the surface.
  - c) They explode from overpressure.
  - d) They remain stationary until acted on by another force.

ANSWER: A--THEY WILL SINK

### BONUS

20. PHYS; Short Answer: If a balloon is inflated to a size of two cubic feet on the surface of the ocean, what volume will the balloon be at a depth of 33 feet?

ANSWER: 1 CUBIC FOOT, DUE TO THE DOUBLING OF THE PRESSURE ON THE BALLOON FROM 1 ATMOSPHERE AT THE SURFACE TO 2 ATMOSPHERES OF PRESSURE AT 33 FEET.

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**TOSS-UP**

21. BIOL; Short Answer: Name TWO of the nucleotide bases of which DNA is composed.

ANSWER: ANY TWO OF: ADENINE (A-DE-NEEN)  
GUANINE (GWA-NEEN)  
THYMINE (THAI-MEEN)  
CYTOSINE (SAI-TO-SEEN)

**BONUS**

21. BIOL; Multiple Choice: DNA is transcribed into RNA, which, in turn, is translated into protein. The sections of genes which are spliced out of RNA are called:

- a) exons
- b) introns
- c) promoters
- d) loci (LO-SAI)

ANSWER: B--INTRONS

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**TOSS-UP**

22. CHEM; Multiple Choice: Which ore contains the greatest percentage of iron?

- a) Hematite
- b) Magnetite
- c) Pyrite
- d) Siderite

ANSWER: B--MAGNETITE

**BONUS**

22. CHEM; Short Answer: Protein solutions layered on glacial acetic acid and concentrated sulfuric acid give a violet ring. What is this reaction called?

ANSWER: ADAMKIEWICZ REACTION

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### TOSS-UP

23. PHYS; Short Answer: Mechanical waves which can be typically heard fall in a rough frequency range between 60 hertz to 20,000 hertz. Sound waves of such high frequency that they normally cannot be heard are commonly referred to as:

ANSWER: ULTRASONIC (ACCEPT ULTRASOUND)

### BONUS

23. PHYS; Multiple Choice: If the primary mechanical wave is a longitudinal wave with particle motion parallel to propagation direction, some of its energy may be converted into a shear (transverse) wave which only travels in a:

- a) Liquid
- b) Gas
- c) Solid
- d) All of the above

ANSWER: C--SOLID

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### TOSS-UP

24. MATH; Multiple Choice: The sum of all the even numbers between 1 and 51 is:

- a) 1300
- b) 650
- c) 325
- d) 675

### BONUS

24. MATH; Short Answer: What is the next number in the sequence: 2, 4, 7, 14, 17, 34,

ANSWER: 37

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### TOSS-UP

25. BIOL; Short Answer: One of the winners of the Nobel Prize for Chemistry in 1993 was Kary Mullis. He had designed a method for amplifying specific stretches of DNA which is called PCR. What does PCR stand for?

ANSWER: POLYMERASE CHAIN REACTION

### BONUS

25. BIOL; Multiple Choice: Which of the following does not result in genetic variability?
- a) cross over during meiosis
  - b) genetic recombination
  - c) gene mutations
  - d) asexual reproduction

ANSWER: D--ASEXUAL REPRODUCTION

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